

GEOMICROBIOLOGY
BIOL/GEOL 467X/667X
Spring 2019

Location: LFG 102; Days: Tuesday & Thursday; Time: 4:00-5:15 pm
Instructor: Dr. Aude Picard

Instructor Contact Information:

- All course matters are to be directed to Dr. Picard using the Canvas messaging feature
- Non-course matters can be emailed directly to audeamelie.picard@unlv.edu
- Office Hours: To be determined or by prior approved appointment

Course description

Study of how prokaryotic organisms (microorganisms) affect geological processes: aspects of microbial metabolism, microbial life in extreme environments, biomineralization processes, origins of life, and some topics in biogeochemistry and astrobiology. Introduction to methods for the study of organic-inorganic interfaces (microscopy, spectroscopy, X-ray diffraction).

Learning objectives

- To acquire basic knowledge of microbial physiology and metabolism and understanding of the role of microorganisms as drivers of biogeochemical cycles (Fe, S, C, O). To understand and define the limits for microbial life in extreme environments and in the deep biosphere. To understand that microbial metabolism can be manipulated in the environment (example of in situ bioremediation)
- To discuss theories about the emergence of life on Earth. To understand how microorganisms preserved in the rock record help reconstructing the evolution of early life on Earth, and how living organisms can become preserved in the rock record.
- To understand how microorganisms influence the formation of minerals and how significant biomineralization processes are. To identify the different forms of biosignatures and their applicability for the search of life on other planets.
- To understand the choice of methodology in the scientific literature by exploring methods useful for the geomicrobiologist (light microscopy, electron microscopy, spectroscopy...).

Texts, readings and instructional resources

Geomicrobiology is a rapidly evolving field. Therefore, most material in this course will be based upon the recent scientific literature. Therefore, the course will include discussions, where students will be required to prepare readings and present it to the other students.

The following books will be useful for this course. None are required and all are available online through the UNLV library's website.

- Brock Biology of Microorganisms (15th ed.) by Madigan et al. (Pearson, publisher)
- Introduction to geomicrobiology by K. Konhauser (2007)
- Ehrlich's geomicrobiology 6th edition (2016)
- Fundamentals of geobiology, Knoll, Canfield & Konhauser (2012)

Additional resources

Guest lecturers from UNLV and from outside UNLV will be invited to present their research to illustrate certain topics of this course (microbial life in extreme environments, biomineralization, paleontology, carbon cycling, methods)

Assignments, evaluation procedures, and grading policy

Academic requirements: Assignments

- 1) Students will be given selected scientific publications to read for the preparation of lectures/topics. Students will have to fill a form to extract and summarize the most important information of the paper. The lecture will be given by the instructor, and students will contribute to their assigned topic by summarizing the literature (mini chalk talks).
- 2) Graduate students enrolled in BIOL/GEOL 667X will also be required to prepare a 45-min presentation on a topic related to geomicrobiology, followed by a 30-min questions & discussion. A list of topics will be discussed at the beginning of the course, but students can come up with their own ideas (to be approved by the instructor).
- 3) All students will occasionally be required to do literature search themselves and find the appropriate papers to illustrate the lectures.

Administrative requirements

Presence is expected and required at all lectures and discussions. Non-excused absences at lectures and/or exams will result in failing this course.

Evaluation procedures and grading policy

For students enrolled in undergraduate BIOL/GEOL 467X, there are 2 lecture exams and a final comprehensive exam. Each lecture exam is worth 20% of the grade and the final is worth 30% of the grade. Class participation makes up the final 30% of the grade.

For students enrolled in graduate BIOL/GEOL 667X, each lecture exam is worth 20% of the grade, the final exam 30% of the grade, class participation 20% of the grade. The lecture is worth 10% of the grade.

Lecture Schedule

Date	Topic
Week 1	Introduction to course Introduction to microbial physiology & metabolism
Week 2	Introduction to biogeochemical cycles Introduction to methods
Week 3	Methods for the geomicrobiologist - microscopy
Week 4	Methods for the geomicrobiologist - spectroscopy
Week 5	Paper discussion Grad student presentation (1)
Week 6	EXAM 1

	Emergence of life on Earth / theories
Week 7	Emergence of life on Earth /discussion Microbial fossilization
Week 8	Compare fossilization of microbes and large organisms
	SPRING BREAK
Week 9	Biomineralization Biominerals as biosignatures
Week 10	Biomarkers & other biosignatures Grad student presentation (2)
Week 11	EXAM 2 Microbial life in extreme environments
Week 12	Deep biosphere Biogeochemical cycle of carbon
Week 13	Biogeochemical cycle of sulfur Grad student presentation (3)
Week 14	In situ bioremediation Grad student presentation (4)
Week 15	Grad student presentation (5)
	FINAL EXAM

Standard provost statements

Academic Misconduct—Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility, and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

Classroom Conduct—Students have a responsibility to conduct themselves in class and in the libraries in ways that do not interfere with the rights of other students to learn or of instructors to teach. Use of electronic devices such as pagers, cellular phones, or recording devices, or potentially disruptive devices or activities, are permitted only with the prior explicit consent of the instructor. The instructor may rescind permission at any time during the class. If a student does not comply with established requirements or obstructs the functioning of the class, the instructor may initiate an administrative drop.

Copyright—The University requires all members of the University Community to familiarize themselves with and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor

defend you, nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at:

<http://www.unlv.edu/provost/copyright>.

Disability Resource Center (DRC)—The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Final Examinations—The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. The general schedule is typically available at the start of the semester, and the classroom locations are available about a month before the end of the semester. See the schedule at: <http://www.unlv.edu/registrar/calendars>.

Incomplete Grades—The grade of “I”—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student’s control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving “I” grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of “F” will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the “I” grade.

Library Resources—Librarians are available to consult with students on research needs, including developing research topics, finding information, and evaluating sources. To make an appointment with a subject expert for this class, please visit the Libraries’ Research Consultation website: <http://guides.library.unlv.edu/appointments/librarian>. You can also ask questions via chat and text message at <http://ask.library.unlv.edu/>.

Rebelmail—By policy, faculty and staff should email students’ Rebelmail accounts only. Rebelmail is UNLV’s official email system for students. As such, it is a primary way students receive official university communications such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. **Emailing within WebCampus is acceptable.**

Missed Classwork—Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only.

It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit:

<http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

In accordance with the UNLV Faculty Senate-approved policy regarding class time and assignments missed, students who represent UNLV in any official extracurricular activity shall also have the opportunity to make up assignments, provided that the student provides official written notification to the instructor no less than one week prior to the missed class(es).

The spirit and intent of the policy is to offer fair and equitable opportunities to all students, including those representing the university in extracurricular activities. Instructors should consider, for example, that in courses which offer a “drop one” option for the lowest assignment, quiz, or exam, assigning the student a grade of zero for an excused absence for extracurricular activity is both contrary to the intent of the Faculty Senate's policy, and an infringement on the student's right to complete all work and fairly earn her or his grade in the course.

This policy shall not apply in the event that completing the assignment or administering the examination at an alternate time would impose an undue hardship on the instructor or the university that could reasonably have been avoided. There should be a good faith effort by both faculty and student to come to a reasonable resolution. When disagreements regarding this policy do arise, they can be appealed to the department chair/unit director, college/school dean, and/or the Faculty Senate Academic Standards Committee.

For purposes of definition, extracurricular activities may include, but are not limited to: fine arts activities, competitive intercollegiate athletics, science and engineering competitions, liberal arts competitions, academic recruitment activities, and any other event or activity sanctioned by a college/school dean, and/or the Executive Vice President and Provost.

Transparency in Learning and Teaching—The University encourages students to use a transparency template to discuss with their instructors how assignments and course activities benefit student success:

https://www.unlv.edu/sites/default/files/page_files/27/TILT-Framework-Students.pdf.

Tutoring and Coaching—The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call 702-895-3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of SSC A (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TBE second floor.

UNLV Writing Center—One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in

consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if <http://writingcenter.unlv.edu/>).

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